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Theoretical Study of the Indirect Quadrupole-Quadrupole Interactions in Metals and Alloys

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Abstract

The indirect multipole interactions of nuclei and impurity paramagnetic ions in metals and alloys via conduction electrons are investigated by means of the dielectric function method. The Hamiltonian of the indirect quadrupole-quadrupole interaction of impurity paramagnetic ions and nuclei is constructed selfconsistently, taking into account the exchange interactions and correlations of the conduction electrons as well as the antishielding effects. It is shown that the energy of these indirect quadrupole interactions of the nuclei and the paramagnetic ions decreases with the distance as R−3, oscillating with a period which is determined by the wave vector on the Fermi surface and the distance R. The influence of these indirect quadrupole-quadrupole interactions on the width and shape of the NMR lines is studied.

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Keywords

Interactions, Metals, Nuclei, Quadrupole, Resonance